Laparoscopic Surgery of the Liver

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The liver, with its multiple metabolic, detoxifying, and filtering functions plays a key role in the field of oncology, as it is the site of both metastatic and primary cancers. This phenomenon occurs because of two factors, namely the proximity of the liver to other intra-abdominal organs as well as the extensive portal vein and lymphatic drainage systems. The lobular structure of the liver represents a barrier to cancer cells which ultimately flourish by producing either synchronous or metachronous hepatic lesions. The size of these metastasizes varies greatly and obeys the laws of expediential tumor growth, thus implying that some lesions will be too small to be detected by conventional methods.

Hepatic oncologic surgery is presently very specialized and requires a dedicated team familiar with the various techniques in hepatobiliary surgery. Laparoscopic surgery, which after several years is now out of its infancy stage, has been applied to most other inter-abdominal organs, with the liver remaining as one of the last uncharted territories. Laparoscopic oncologic surgery of the liver is to be performed with caution by experienced hepatobiliary surgeons who carefully follow established guidelines, who are familiar with the complications of hepatic and laparoscopic resection, and who are able to convert to open surgery if necessary.[6,9,10]

PREREQUISITES FOR LAPAROSCOPIC SURGERY OF THE LIVER

It is essential for the surgeon to have experience in open hepatobiliary surgery, but it is also important for him to have at his disposal an experimental laboratory in order to gain confidence in laparoscopic surgery. The surgeons needs to become adept at handling laparoscopic instruments for use on the liver and to completely master the techniques of hemostasis and biliostasis. This goal can be achieved by carrying out experimental surgery in animals.

It is also necessary to have specialized equipment available. These requirements are more important for

surgery of the liver than for surgery of other inter-abdominal organs. Unfortunately, equipment for laparoscopic surgery, such as the Yag laser, can be very expensive. To alleviate this problem, it is essential that the various disciplines share the equipment and thereby make it cost effective.[2,3,11]

INDICATIONS

In the field of oncology, diagnostic laparoscopy can prove to be very useful for detecting a variety of liver malignancies which would not be discernible by other conventional imaging techniques such as CAT scans, MRI, Duplex and hepatic arteriography. For example, cancer of the pancreas is commonly accompanied by multiple hepatic metastasizes which are small in size and diffusely located throughout the liver parenchyma. Because of their small size, these metastasize are at times not detected by the usual imaging methods; however, they can usually be seen with the laparoscope. This allows the surgeon to more accurately predict curative versus palliative resection. Another example where laparoscopy can be useful is with cancer of the gallbladder in elderly persons. Pre-operative imaging may indicate the presence of such a cancer however, ultrasonography does not always reveal localized hepatic involvement. Here a laparoscope introduced through the umbilicus with a single trocar will allow a clear diagnosis to be made and will allow for biopsies to be taken as well. Finally, in the case of localized colorectal cancer, laparoscopic resection should be proceeded by a thorough examination of the liver to exclude metastasizes. Here laparoscopic ultrasonography examination at the time of the resection is also useful.

Lymph nodes present in the porta hepatis, demonstrated with imaging techniques, are also an indication for diagnostic laparoscopy as lymph node biopsies can be performed which will better help in disease staging. In the case of cancer of the stomach, pancreas or gallbladder, these lymph nodes can be involved, thus changing the surgical indications from curative to palliative surgery.

A further indication for laparoscopy is to distinguish benign hepatic tumors such as adenomas and focal nodular hyperplasia from hepatic metastasizes. Laparoscopic resection of tumors in the liver, with a 2 cm margin is feasible as is a one or two segmentectomy. Finally, a left lobectomy is feasible, but this resection calls for considerable experience. It should be noted that these resections are usually applied to hepatic malignancies, but they can also be applied to non malignant tumors of the liver for which there is a formal indication, such as with hepatic adenoma which has increased in size or has been complicated by hemorrhage in women taking oral contraception.

Unfortunately, in primary liver cancer, the tumors are often very large at the time of diagnosis and resection by laparoscopy is not a reasonable procedure. Laparoscopic resection is also not recommended if the liver is cirrhotic given the risk of hemorrhage which can occur at any time with possible fatal consequences. Currently, laparoscopic resection in the presence of cirrhosis cannot be recommended routinely, although it already has been performed in humans.

SPECIALIZED EQUIPMENT

In addition to the basic laparoscopic instruments, it is necessary to have a variety of instruments that are adapted to hepatic surgery. High quality scopes with a 0° as well as a 30° and even 45° viewing range must be available. The 30° scope is indispensable in liver surgery as it enables observation of blind areas which cannot be seen by the traditional 0° scope, such as the posterior side of the liver and the lateral regions. Moreover, the examination of the blood supply to the tumor can be achieved only with the 30° scope.

The video camera needs to be of high quality and must have the discernment capacity needed to completely and accurately visualize hemostasis and biliostasis. The light source must be powerful (250W halogen or Venor). Finally, the video monitors must also have the correct dimensions, at least 51 cm, and it is necessary to have two screens so that the surgeon and the assistants have a complete view of the operation.

There is nothing specific about the trocars, but it is note worthy that a sufficient trocars should be available. A variety of instruments should also be available. The forceps used on the liver should be atraumatic, preferably with no teeth. The so-called "crocodile forceps" or forceps with large teeth are ineffective and increase the risk of hemorrhage. All of the forceps should be insulated and should rotate. It is also desirable to have completely insulated rotating regulation scissors as well as a hook. Automatic clip appliers, which allow the clips to be loaded without withdrawing the instruments for reloading, are also mandatory. Finally, stapling devices with vascular clips are useful for certain vascular pedicles. A variety of needle holders is also necessary.

Among the instruments more specific to liver surgery are the ND-Yag Laser and the ultrasonic dissector (Cusa-CEM™, Valleylab, Inc., Boulder, Colorado, USA). The ND-Yag Laser is the instrument which is most adapted to surgery of the liver. Its capacity for greater penetration than the CO_2 argon lasers enables a correct cut to be carried out, as was experimentally demonstrated during the excision of hepatic metastasize comparing the Yag Laser to conventional electrocautery.[14] This instrument is very costly, however, and its acquisition is best done on a multidisciplinary basis, which will allow the different disciplines to share its utilization and cost. The ultrasonic dissector is also an extremely valuable instrument. It enables precise dissection of the hepatic parenchyma, thus revealing the vasculobiliary radicles and allowing a step-by-step dissection of these structures (Tetrad Corporation, Englewood, Colorado).

Another instrument which is of great help in the liver resections is the "Harmonic Scissors" from Ultracision Inc. The principle of the instrument is based on a high speed oscillations of the blades that induces cutting and hemostasis without thermal damage to the surrounding structure. Preliminary studies have shown that this instrument also seals bile ducts.

Pretied catgut endoligatures as well as finer sutures of monofilament preferably without memory should also be available for internal suturing. This type of monofilament ligature is also very useful for extracorporeal tying with the Roeder knot. Specimen bags must be strong and easily closed.

Tissucol® Fibrin Glue (IMMUNO AG., Vienna, Austria) is indispensable for hemostasis after laparoscopic hepatic resections and is applied on the raw hepatic surfaces. This adhesive fibrin sealant is available in various concentrations with various setting times. It should be applied without pressure to

the raw surface of the liver at the end of the resection. In addition, Omentum can be used to cover the raw surfaces of the liver at the end of the procedure.

PATIENT AND OPERATING ROOM TEAM POSITIONING

(Figure 1) For positioning, we have opted for the so-called "French position". The surgeon positions himself between the patient's legs which are placed in modified lithotomy. This position is very comfortable for the surgeon as it prevents unnecessary bending, and it provides a symmetrical view across from the patient. It also allows for free use of the hands, while enabling the foot pedals to be maneuvered. This position is also very convenient for the assistants on each side. The two monitors are placed on each of the anesthesiologist near the head of the patient so that the whole arrangement is coherent and ergonomic. The scrub nurse should be to the right of the surgeon beside the assistant allowing him to pass the instruments to the surgeon's right hand. All of the traditional basic instruments for open surgery must be available in the operating room as well, in case the need for conversion arises. The usual roles of anesthesiology for hepatic surgery are followed, but is necessary to emphasize that the anesthesiologist must be aware of the additional hazards of laparoscopic surgery. Measures must be taken to ensure that there is equipment in the room for rapid transfusion of blood with a variety of blood products available. With the proper preparation and equipment, laparoscopic surgery can take place in relative comfort and safety.

INSTRUMENT POSITIONING

A minimum of four trocars and cannulas will be introduced if the planned intervention is more than diagnostic laparoscopy. The placement of trocars should allow enough space between them to avoid the "knitting needle effect" of various instruments. There is no ideal position for the trocars for this type of surgery. All of the trocars must be at least 10 mm in order to allow repositioning of the camera for visualization of the lesion and the parenchyma from different angles. The cannula for the laparoscope is usually introduced in the umbilicus, with the cannula for the graspers on the left side and one for the instruments on the right side. This triangle can be converted to a rectangle by placing a fourth trocar for irrigation aspiration probe. This general scheme can be modified according to the location of the lesions and the working method with which the surgeon is accustomed. Additional equipped trocars, up to five or six in maximum number, can be introduced for the use of the Yag Laser or the Cusa-CEM™.

The new "personal positioning" concept is the four hands approach with two surgeons operating simultaneously. One surgeon uses the grasper and the laparoscopic Cusa-CEM™, while the other surgeon manipulates the scissors and clip appliers (Figure 2).

APPROACH FOR HEPATIC LAPAROSCOPIC SURGERY

As in open surgery, hepatic laparoscopic surgery begins by mobilizing the liver which clears the area surrounding the lesion so that there is direct and precise access. The procedure which is familiar to all hepatobiliary surgeons involves division and ligation of the round ligament between clips, sectioning falciform of the ligament in order to lower the upper and posterior of the surface of the liver, sectioning of the left triangular ligament in the event the lesion is in the left lobe, and the more difficult partial division of the right triangular ligament for a right posterior lesion. In the event of a major resection, it is necessary to be able to approach the side of the superior vena cava and the trifurcation of the hepatic vein, in particular the left hepatic vein. Careful dissection and mobilization could prove to be extremely useful, in case resection of the left lobe becomes necessary. Once the liver is completely mobilized, an incision is made in Glisson's capsule using a coagulating hook or the Yag Laser followed by forceps fracture of the liver simulating the open finger fracture method. The ultrasonic dissector comes in very handy at this point enabling one to pulverize the

Figure 1. Position of the surgeon between the patient's leg.

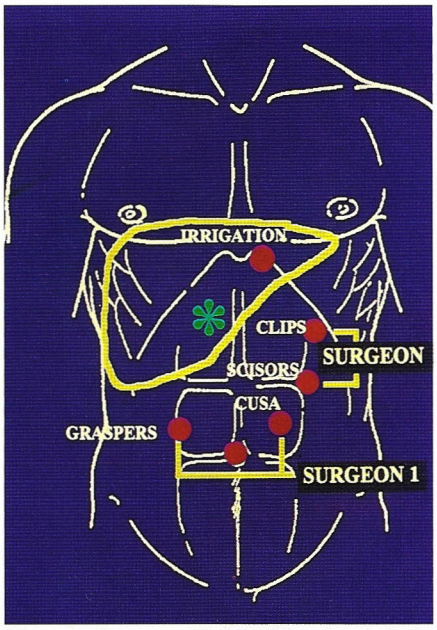

Figure 2. Trocar position for "four hands technique."

parenchyma while preserving the vasculobiliary elements. All of these large size vascular and biliary radicals must be clipped. In the case of major vessels or biliary ducts, one must not hesitate to resort to the use of extracorporeal ligatures (i.e. sliding Roeder knot). Finally, at the end of the operation the ablated segment must always be placed in a bag allowing for extraction without spillage. This extraction is usually done by enlarging the umbilical opening. Another option is to partially morcellate the resected specimen with Kelly forceps should an electric morcellator not be available. Finally, another option for removal in a female patient is posterior colpotomy extraction which, of course, requires appropriate and precise re-approximation and resuturing. This type of extraction does not entail any delayed complication if the repair is done correctly. It is important to note that a specimen should never be reduced to total pulp as this will prevent any type of postoperative histological and pathological examination.

DIAGNOSTIC LAPAROSCOPY

As we have previously discussed, diagnostic laparoscopy of the liver is extremely important in liver malignancies as it enables the detection of small tumors as well as metastasizes. It offers the opportunity to confirm or to invalidate the preoperative diagnostic assessment, and due to the magnification provided by laparoscopic surgery, biopsies can be carried out relatively easily and safely.

Laparoscopic ultrasonography is an invaluable technique in the study of the liver and allows for the detection of a deeper liver metastasizes as well as for the definition of the attachment of metastatic lesions to a vital structure such as hepatic veins. Hepatic pedicle as well as the hilum can be clearly seen. Thanks to the inter-operative ultrasonography biopsies can be performed without fear of causing major hemorrhage or bile leaks. These ultrasonographic probes are always being improved and we can expect very effective instrumentation in the near future which will increase the precision of laparoscopy especially when coupled with Doppler probes (Tetrad Inc.) (Figure 3).

Figure 3. Laparoscopic Ultrasounds.

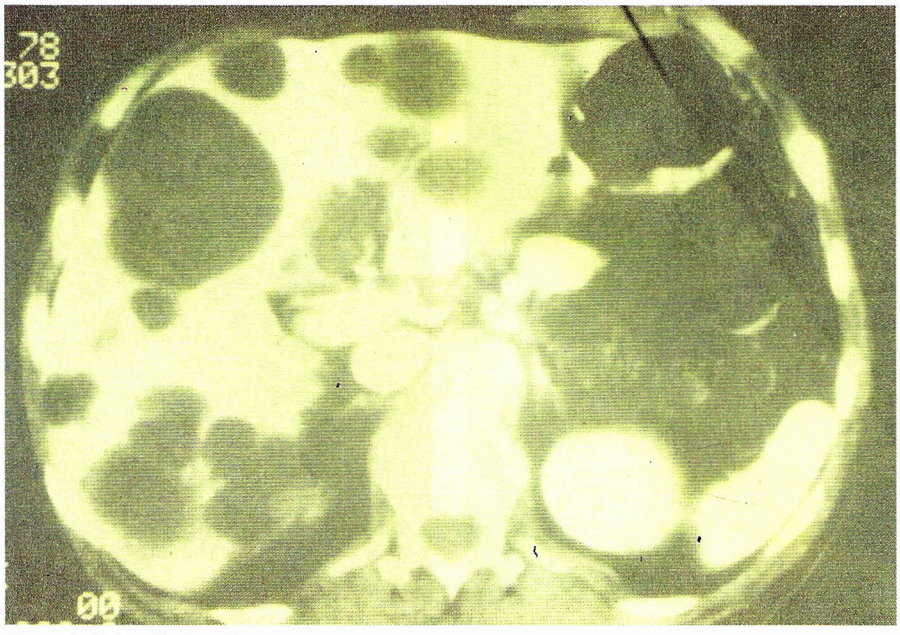

Figure 4. Polycystic liver disease.

LAPAROSCOPIC TREATMENT OF BILIARY CYSTS

(Figure 4) Biliary cysts are intrahepatic lesions usually containing a clear serous fluid and do not communicate with the biliary tree. They are usually lined with biliary like epithelium. They are classified as either simple biliary cysts or as components of polycystic liver disease.[15,16] Simple biliary cysts are detected in as many as two to four percent of routine hepatic ultrasonographic examinations. Polycystic liver disease is hereditary disease transmitted as an autosomal dominant trait. It is currently associated with progressive hepatomegaly as well as multiple renal cysts. The vast majority of biliary cysts are asymptomatic even as their size and number increase with time. However, in five to 10% of patients symptoms can occur as these cysts enlarge and compress adjacent structures causing gastric or duodenal obstruction, jaundice or even portal hypertension. Biliary cysts less commonly may become infected, bleed or may rupture into the perineal cavity.

Previously, patients with symptomatic biliary cysts were treated by peritoneal aspiration alone, by aspiration followed by alcohol injection, or by unroofing the cysts via open laparoto-

my.[17] Although popular, percutaneous aspirations effect is usually only transient. Recently, it has been shown in both solitary and multiple biliary cysts can be successfully managed laparoscopically.[6,10,18]

Technique

Initial evaluation involves careful preoperative assessment by imaging studies to delineate the sites of the biliary cysts. Four laparoscopic cannulas are introduced and when viewed laparoscopically, the cysts usually appear as convex distortions along the surface of the liver, often having a characteristic bluish color. The dome of the cysts is identified and opened and enlarged with an electrocautery hook or curved scissors, resulting in a spurt serous fluid. This fluid is equipped with an aspiration probe and sent for bacteriologic studies. The wall of the cysts is then grasped with forceps and is excised with an electrocautery hook or curved scissors. This dissection is continued until the entire accessible portion of the cyst wall is excised to a point within 2 mm of the cyst parenchyma junction. A portion of the cyst wall should be sent for histologic examination.

Hemostasis is confirmed and attention is then directed toward the next cystic lesion. In patients with multiple cysts, one can often unroof a deeper cyst through a previously opened cyst cavities, the so-called transcystic fenestration. These maneuvers are repeated until all possible cysts are opened, drained and excised. In most patients, postoperative drainage catheters are not necessary.

LAPAROSCOPIC TREATMENT OF HYDATID CYSTS

Thus far, our experience in laparoscopic guided liver resection has been limited to the wide excision of hydatid cysts. This cyst is a parasitic lesion of the liver resulting from infestation by the parasite Echinoccous Granulosum. The definitive host of this tape worm is a dog, with man, sheep and cattle being intermediate hosts. The dog is infected after ingesting the viscera of sheep that contain the hydatid cysts. Scolices of the cyst attach themselves to the small bowel of the dog and develop into adult worms. Ova are then later shed by the worm into the lumen of the intestine and are carried out with the feces, contaminating the grass and crops. Infection in man occurs after ingestion or contaminated vegetables or even after simply handling of the dog as the ova also adhere to the animal's hair. The outer envelope of the ova is dissolved by the gastric juices, and the liberated ova then penetrate the wall of the intestine. Cysts are then carried by the blood flow into the liver where they develop into adult cysts.

Although far less common, ova can also be found in lungs, spleen, brain and bone.[19,20] Hydatid cysts are more often found in the right lobe of the liver and usually invoke a strong inflammatory reaction within the surrounding tissue. Fibroblasts are attracted forming a thick capsule like layer which calcifies. Untreated hydatid cysts will frequently rupture into the peritoneal cavity resulting in anaphylactic shock, peritonitis or bowel obstruction. Cysts may also decompress into the bile ducts leading to cholangitus and the bile duct may become secondarily infected with bacteria. Antihelmintmic drugs are ineffective against the parasite. The only effective method for liver involvement remains surgical excision.[9,20]

Technique

The principle of our laparoscopic approach is identical to that of the conventional open procedure, emphasizing a complete paracystectomy without opening of the hydatidoma. The patient is positioned as described earlier with the surgeon standing between the patient's legs. The pneumoperitoneum is established via either the percutaneous or open technique, and four laparoscopic cannulas are inserted. An abdominal exploration is performed to detect additional lesions that may have been missed on the preoperative imaging studies. Patients of one or more hydatid cysts often have inflammatory adhesions in and around the liver, and these should be freed using electrocautery scissors. Occasionally it is necessary to divide the triangle ligament to obtain access to lesions within the left of the liver. To facilitate hemostasis, electrocautery scissors are also used to accomplish this maneuver because there is usually a moderate size vein coursing within these tissues.

After the hydatid cysts is exposed, Glisson's capsule surrounding the lesion is scored with a contact tip in the glazier set at 50 watts continuous mode. If there is persistent bleeding from smaller blood vessels, the sapphire tip can be removed and the defocused beam can be used for coagulation. This dissection is carried out slowly and methodically around the perimeter of the lesion developing a plane of dissection adjacent to the capsule like cyst wall but outside of the very friable hepatic parenchyma. The electrocautery spatula is also useful for this portion of the procedure and its rounded tip is used to bluntly dissect within the hepatic parenchyma. In contrast to other laparoscopic procedures, the electrocautery hook is less useful. The magnification by the video laparoscope system proves to be an advantage dur-

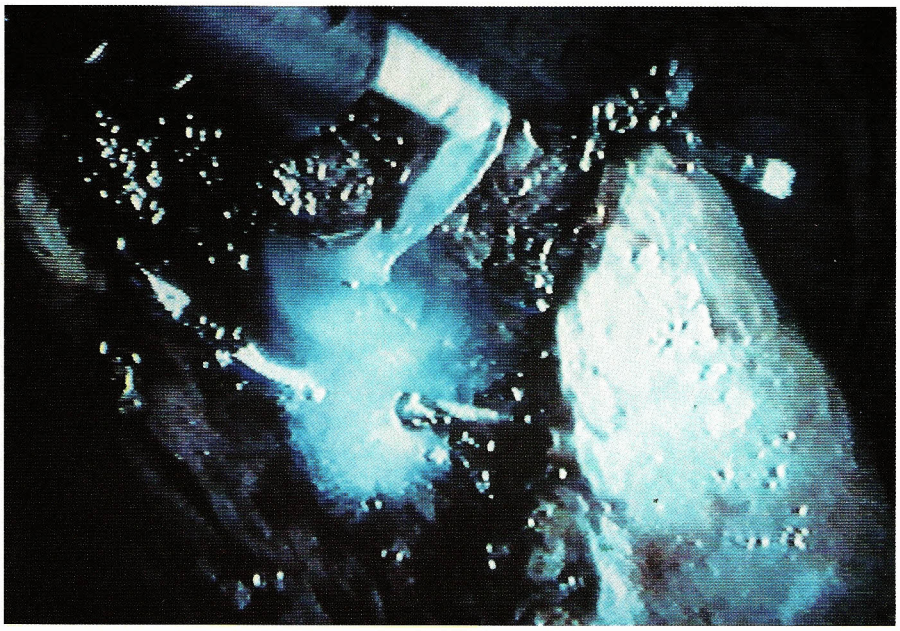

Figure 5. Application of fibrin sealant after liver tumor resection.

ing this segment of the operation as it allows the surgeon to identify even the smallest of vascular and biliary structures within this tissue plane. Vessels and ducts larger than 1-2 mm in diameter are individually ligated, surgically clipped and divided with scissors.

Another method for hemostasis in this area is the application of fibrin glue (IMMUNO AG., Vienna, Austria). This material can be applied along the raw liver surface and can be very effective in controlling bleeding as well as bile leakage from smaller transsected ducts. (Figure 5)

The operative dissection is continued until the entire cyst is freed from the liver. Often, smaller probes are used to expose the deeper portions of the tissue plane. If necessary, additional cannulas can be inserted to help provide improved exposure. Blind dissection deep within the cavity space should be avoided because of the risk of cyst perforation. After the hydatid cyst is removed from the liver, it is placed within a sterile bag in preparation for extraction, thus minimizing the risk of spillage of cyst contents into the peritoneal cavity. The bag and enclosed cyst are then removed through the umbilicus. If necessary this opening can be enlarged in order to accommodate the specimen. Alternatively, a large Kelly clamp can be inserted through the fiscial opening into the bag to morcellate the tissue. An automatic or electrically powered morcellating device is available as well, however, morcellation makes histologic examination more difficult.[6] Fibrin glue can also be injected into the cavity space, compressing the edges of the cavity with atraumatic forceps until bleeding or bile leakage is controlled. Closed section drainage catheters are then placed under laparoscopic guidance along the liver edge. Such drains are routinely employed in open hepatic surgery so we have decided to continue this practice with the laparoscopic approach. The pneumoperitoneum is completely removed from the peritoneal cavity, which in our experience basically diminishes the amount of postoperative discomfort. The umbilical facia opening is closed, and skin edges are then closed with sutures or staples.

Special Considerations

In patients with very large hydatid lesions, numerous vascular and ductal attachments may be present and in these cases it is therefore important to have a preoperative evaluation of these structures, including selective arteliography and cholangiography. If a major bile duct leak is suspected during the operative procedure, the surgeon can perform a cholecystectomy and obtain a standard cholangiogram. Alternatively, the surgeon may inject methylen blue through the cholangiogram catheter to look for extravasation within this cavity. On the basis of these studies, the surgeon can then decide whether the internal bile duct leak is occluded with the laparoscopically placed sutures or requires open exploration with steril placement.

In the case of the posterior cyst, the deroofing technique is preferred with installation of hypertonic saline prior to the resection in order to kill the parasite.

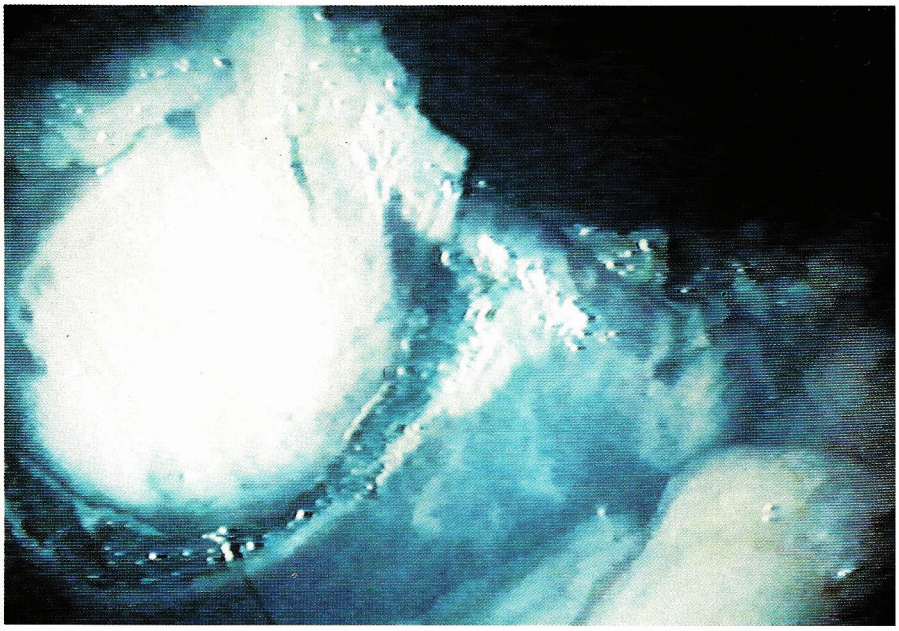

Figure 6. Hepatic Metastasectomy.

LIMITED RESECTION OF MINOR NEOPLASTIC LESIONS

Metastasectomy is an example that best illustrates these techniques. A small size metastasize in the left lobe is ideally suited for laparoscopic resection. Four trocars are necessary for access with the umbilical trocar for the video laparoscope, two lateral trocars for grasping forceps and other instruments, and the subxiphoid trocar for the irrigation/aspiration probe. This port can also provide access for the ND-Yag laser and the clip applier.

The resection begins by incising Glisson's capsule 2 cm from the metastatic lesion with electrocautery (Figure 6). Here laser resection is ideal as there is less smoke generated than with the use of conventional electrocautery. The smoke is intermittently suctioned through the xiphoid irrigation/aspiration cannula. Next, the dissection is carried progressively deeper into the hepatic parenchyma while separating the edges of the liver with the left-handed forceps. At this point, the addition of a fifth trocar for insertion of the grasping forceps to be used by the assistant to remove the tumor mass is useful so as to create a groove which a hook or coagulating scissors can pass. Atraumatic forceps will allow the minute structures to be coagulated as they pass through this groove. In case of larger vessels, clips must be used and it is recommended that a double clipping technique be used in order to avoid inadvertent avulsion of a single clip from the vascular pedicle. It is necessary at this point to use irrigation/aspiration probe in the deep groove of the liver to keep the operating field dry. Maintenance of a bloodless field via rinsing of the dissection cannot be overemphasized. Once dissection is complete, a cannula is inserted to deliver fibrin glue (TISSUCOL®, IMMUNO AG., Vienna, Austria) as the last step of the operation. In the case of the small metastasectomy, drainage is not necessary, while in the cases of larger resections, we routinely perform cholangiography at the conclusion of the resection in order to identify any possibly biliary leaks, having previously performed a cholecystectomy. Metastasize of a maximum of 5-8 cm can be extracted without difficulty by enlarging facial incision at the umbilicus so the extracted specimen is left intact.

LEFT LOBECTOMY

Broader resections are designed for larger tumors located in the left lobe for which enucleation may prove to be incomplete or inadequate treatment. A left formal lobectomy may also be appropriate for larger lesions in the left lobe. However, the left lobectomy should only be considered by surgeons who have extensive experience in laparoscopy as these maneuvers are much more difficult than those performed during open surgery.

Laparoscopic left lobectomy, nevertheless, follows the same rules as in open surgery. The surgeon must be patient and must carefully achieve a vascular isolation which can be done using extracorporeal ligatures. A dissection into the parenchyma is performed after the incision in Glisson's capsule, with exposure of segments two and three. Hemostasis and ligation of biliary radicals is performed using clips reinforced with ligatures. In general, the lobectomy specimen, which is placed in an extraction bag, is then withdrawn having undergone some degree of morcellation, or as in the case of a female patient, having been removed by posterior colpotomy. The raw hepatic surface is inspected and hemostasis is completed using fibrin glue. The greater omentum can also be used as coverage of the raw surface of the liver. A cholangiography for the purpose of detecting possible bile leaks is also useful. After left lobectomy, we recommend the placement of a two-suction drains near the edge of the wound so as to collect any minor persistent leak of blood or bile and to prevent hematomas. Smaller resections or redissection are done in the same way and with the same concern for hemostasis and control of biliary radicals.

One cannot overemphasize the need for precise vascular control so as to avoid CO_2 gas embolization. In general, the risk in laparoscopic surgery is minimal, as the gynecological series has demonstrated. However, it is a much greater risk in the surgery of organs that are well vascularized, as in the liver and the spleen as they are directly linked to the inferior vena cava and the heart. The risk is not insignificant and should be a constant concern. The patient must be constantly monitored by an anesthesiologist and carefully watched postoperatively as well.

TREATMENT AND PREVENTION OF INTRAOPERATIVE COMPLICATIONS

The major intraoperative complication is hemorrhage. Minimal ooze can be controlled with unipolar or bipolar forceps or a coagulating spatula can be used. Fibrin glue placed on the raw surface of the liver is also helpful. In the case of the more serious arterial bleed which is heralded by a clearly visible spurt of blood, it is necessary to grasp the artery immediately with atraumatic forceps and to apply a clip or ligature. The management of venous bleeding tends to be more complicated as there is often a constant ooze in hepatic surgery, and hemostasis can be extremely difficult. Placing sutures laparoscopically is not easy. Temporary tamponade can be used to stabilize the situation to the extent of venous injury can be assessed. A bleeding from a small aspirated vein can generally be controlled with coagulation or a clip. If venous injury is more extensive, such as with a hepatic vein or branch of the portal vein injury, one must not hesitate to perform a subcostal incision which will then allow for accurate assessment and correction of the situation. It should be stressed that conversion is not an admission of failure, but of good surgical judgment. The safety of the patient is always a first priority. Control of biliary leaks is generally easier to accomplish since the biliary range can be seen clearly with magnification via laparoscope.

Another complication, as previously mentioned, that can occur, is that of CO_2 gas embolization. It is necessary to emphasize the importance of careful handling of large vessels to avoid injury with scissors. Division of these vessels should only take place after coagulation or control with clips or ligatures.

Finally, there remains the difficulty of extracting a large specimen which can be morcellized or removed via posterior colpotomy in females.

CONCLUSION

Laparoscopic liver surgery is an exciting but demanding field requiring considerable experience and competence. This surgery is useful not only for diagnostic purposes but also for resection of well defined hepatic lesions. It also offers less postoperative incisional pain. Future trials are necessary to more fully evaluate the efficacy of laparoscopic liver resection. STI

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